Inequality in workers' lifelong learning across european countries: Evidence from EU-SILC data-set

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16 September 2009

Inequality in Workers' Lifelong Learning across European Countries: Evidence from EU-SILC Data-set

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Preliminary draft: this version 16 September 2009

Abstract

The primary purpose of this paper is to explore the potential for EU-SILC data to deepen our understanding of the determinants of inequality in workers' formal life-long learning (LLL) in Europe. In particular we investigate the incidence of personal, job-specific and firm-specific characteristics on the workers' probability to undertake adult learning. To do so, we first estimate LLL incidence in the whole sample for men and women. Then we estimate separate 21 country-specific equations, for both sexes. This method allows to investigate cross-country gender differences and avoid unobserved heteroscedasticity due to sex, which we clearly find in the data. For the whole sample the results show that, for both men and women, formal LLL incidence is significantly higher among young, better educated, part-time and temporary workers, and lower among those who changed current job in the last year, employed in small firms and having low-skilled occupations. Furthermore, some gender differences for the whole sample emerge. When estimating separate equations for each country and for both sexes, a significant cross-country heterogeneity and a weaker significance of the coefficients come to light. In particular, a couple of relevant results emerge for Scandinavian countries with regard to the complementarity between past level of education and current adult learning. Finland is the only country in the sample in which, for both men and women, less educated workers are more likely to undertake formal LLL, thus making adult learning system able to avoid, for both men and women, existing inequality in human capital, as it results from education levels. Denmark is the only country where, for women, being less educated turns out to be the predictor with the greatest significant magnitude of the effect in the variation of the probability.

Keywords: education, training, lifelong learning, human capital, inequality, Europe.
JEL Classification: J24, J40

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1. Introduction[1]

It is largely accepted by economic literature that human capital - conceived as an heterogeneous aggregate – is a key element for economic growth. Individuals can accumulate regular skills not only through education but also through on/off-the job training. Furthermore, and most importantly in terms of evaluation of the human capital effects, it turns out to be a continuous process starting at school and keeping on spreading out in the labour market through adult learning. Human capital can be accumulated not only before getting a job, through pre-occupational education but also during working life by nurturing continuous learning and/or training.

Although the European Jobs Strategy's emphasizes adult education during working life, empirical literature, by focusing on the growth effects of the initial education, does not seem to take sufficiently into account the contribution of work force life-long learning (LLL) as an additional source of human capital and growth.

However, despite recent increasing participation in some learning programmes of adult workers, a significant inequality across countries and among different categories of workers still exists. In particular, four questions are relevant here: 1) What does affect inequality in workers' human capital accumulation in Europe? Individual-specific, job-specific, or firm-specific characteristics? 2) What is the extent of gender differences? 3) Is there a significant heterogeneity across European countries in terms of gender as well? 4) Is there a complementarity between past education and adult learning? In other words, are labour market institutions able to avoid or reduce existing inequality in human capital as it results from education levels obtained before working?

In this paper we try to answer these questions by using the last European data-set, the Community Statistics on Income and Living Conditions survey (EU-SILC) that has never been used yet, to our knowledge, in studying inequality in the incidence of workers' learning

[1] We would like to thank Giuseppe Croce, Maurizio Franzini, Michele Raitano, Massimiliano Tancioni and participants at the CRISS seminar, University "La Sapienza" of Rome, at AISSEC Conference, Perugia 25-27 June 2009, for their valuable suggestions and comments. The views expressed in this article are those of the authors and, in particular, do not necessarily reflect those of the Ministry of Economic Development. The usual disclaimer applies.

process. Since 2005[2] EU-SILC has succeeded the European Community Household Panel (ECHP). Firstly, it offers two advantages with respect to the EHCP, more precisely: a) providing an update of indicators, and b) covering a larger number of European countries. Indeed, for the first time, data on EU25 member states are available, while ECHP covered only 14 countries. Secondly, it keeps the main advantage that EHCP had on other data-set: that is comparability attained by using common guidelines, definitions and procedures. Thus EU-SILC is able to compare a much higher number of European countries whose different educational systems and labour market institutions are quite different.

Our interest focuses on evaluating gender differences in the incidence of formal LLL amongst workers, both in the whole sample and in each of the 21 countries having available data out of the 25, especially regarding the following aspects: age, marital status, complementarity between past education and current adult learning, permanent vs. temporary jobs, full versus part-time contracts, recent job changes, working in small vs. being employed in medium and large companies, being involved in low vs. high-skilled occupations.

We choose to adopt the following procedure. First we estimate the determinants of LLL participation, for the whole sample by using separate equations for men and women. Then, similarly to Arulamnlam et al. (2004) - who adopted this method to estimate training incidence in ten European countries - we also estimate, for each of the 21 European countries, separate equations for men and women, which, to the best of our knowledge, has not been done before in comparative analysis of life-long learning. This procedure allows for the identification of cross-country gender differences in the impact of observable characteristics on LLL inequality in Europe. We finally exploit the cross section nature of the EU-SILC data set to control for heteroscedasticity due to sex.

This empirical paper is organized as follows. The next section reports the main findings achieved by recent literature. Section 3 describes the data. Section 4 reports the results of the

[2] Indeed, EU-SILC was launched gradually between 2003 and 2005 in all EU Member States and has become the source of data for the analysis of income distribution and social inclusion at EU level. More precisely, EU-SILC was first brought out in 2003 on the basis of a gentlemen's agreement in six Member States (Belgium, Denmark, Greece, Ireland, Luxembourg and Austria) as well as in Norway. In 2004, under Regulation N° 1177/2003 of the EP and European Council, EU-SILC was implemented in twelve EU-15 countries (Germany, Netherlands and the United Kingdom delayed the launch for one year) as well as in Estonia, Iceland and Norway. In 2005, EU-SILC was operating in all EU-25 countries, plus Iceland and Norway, all with available cross-sectional data. Bulgaria, Turkey and Romania launched EU-SILC in 2006, and Switzerland followed suit in 2007. Former Yugoslav Republic of Macedonia and in Croatia are evaluating its start as well.

formal LLL incidence. Section 5 is devoted to check for possible unobserved heteroscedasticity due to sex. In the last section we present our main conclusions.

2. Previous literature

2.1. Different data set and different definitions of adult learning

Different surveys are currently used to determine the incidence of adult learning. The most relevant of them were available since very recently. All these surveys evaluate human capital accumulation from different point of views, and consider different definitions and concepts (Bassanini et al. 2007, Jenkins et al. 2002, OECD 1999, , Ok and Tergeist 2003). This is the main reason why it is frequently quite difficult to compare empirical results and why this line of economic literature is still far from being clear under plenty of aspects.

The most used surveys are the following:

- *The European Community Household Panel (ECHP)*, which is probably the most common. It focuses on educational activities taking the form of courses. The question included is: *"Have you at any time since January (in the previous year) been in vocational education or training, including any part-time or short courses?"*. Then individuals who have been enrolled in any education or training schemes during the reference period are asked whether they have attended some courses, including general education, vocational or training and language programmes.

  The ECHP came to an end in 2001 after operating during eight years, and has been replaced by "EU-SILC" which is the acronym for "European Union Statistics on Income and Living Conditions"[3].
- *The International Adult Literacy Survey* (IALS) which uses a very broad definition of education and training, including "any training and education courses, private lessons, correspondence courses, workshops, on-the-job training, arts, crafts, recreation courses or any other training or education". Its sample size is also relatively quite small.
- The *European Union Labour Force Survey* (ELFS) which provides information about workers' participation in training and education schemes during a period of 4 weeks prior to the survey. Since 1998, the survey also provides information in the questionnaire about the purpose of the training received. A distinction is also

3 For the transition period between ECHP and EU-SILC see Eurostat (2005)

available between initial vocational training, continuous vocational training, training under a specific employment measure and training for general interest.

- *The European Working Conditions Survey* (EWCS) and the *Continuous Vocational Training Survey (CVTS)* which only include employer-sponsored training. This feature may explain the lower estimates of adult learning obtained when using this dataset.
- *The OECD Aggregate data* which are the result of merging CVTS and IALS data on both training participation rates and training hours per employee[4]

These surveys significantly differ in terms of the definition of learning adopted, which clearly affects how to gauge the extent of inequality in lifelong learning participation. That may generate conclusions which can be quite dissimilar, although some correlations are observed.

As a matter of fact, on the one hand, some studies (Ariga and Brunello 2006, Arulampalam et al. 2004, Bassanini, et al. 2007, Brunello 2003, Pischke 2001) generally canvass a broad definition of training, by using different data-set. They also generate different binary dependent variables within the same survey, depending on the specific question used by survey and the personal procedure adopted.

On the other hand, a few studies are able to show the incidence of a larger definition of adult learning during working life, which includes both education and training programmes. In particular, Simonsen and Skipper (2008), by using a panel data maintained by Statistics Denmark from 1990-2002, investigate the presence and incidence of lifelong learning in that country. Drewes (2008), using data from statistics of Canada's Survey of Labour and Income Dynamics (SLID) analyzes the extent of adult education and training in that country. Ok and Tergeist (2003), using data from IALS and ECHP, evaluate the diffusion of continuous education and training (CET) across OECD countries. Jenkins et al. (2002), using data from National Child Development Study, investigate the incidence of lifelong learning in UK between the ages of 33 and 42. Sargant et al. (1997) study the extent of adult learning in the same country using National Institute of Adult Continuing Education (NIACE) survey. Here, we adopt a procedure similar to this second line of research: indeed our aim is to verify whether or not a worker is currently involved in any formal life-long learning process which may improve its own skills, by including both regular education and training programmes.

[4] For a large description see Bassanini et al. (2007) and OECD, 2004

2.2 Explaining participation in adult learning: main results

Despite different concepts of adult learning, results from previous studies can be summarised. Some regularities have been found: young and better educated workers, involved in highly-skilled occupations and in large firms enjoy greater learning opportunity[5]. These findings can be easily defined as stylised facts.

However, empirical economic literature has to put some light on many other interesting aspects. Firstly, results show that complementarity between past and current education and, more in general, inequality in the incidence of workers' learning varies significantly across nations, particularly in Europe (Arulampalam et al. 2004, Bassanini, et al. 2007, Brunello 2003, OECD 1999, Ok and Tergeist, 2003).

Secondly, the effect of labour market conditions on incidence of adult learning is ambiguous. Temporary and part-time workers generally receive less training, especially when it is employer-provided (Bassanini et al. 2007, OECD 2002). Nevertheless, Arulampalam et al. 2004 do not find a significant difference in training probability between casual and permanent workers, with the exception of Denmark, and between part and full-time workers, with the exception of UK and Finland. When the definition of learning is broadened so to involve both education and training, the sign of correlation may be inverse. Drewes (2008) shows that permanent workers are less (more) likely to receive education (training) and that recent job changes increase education and training probability during work.

Thirdly, there is no accepted evidence of whether female are more likely to receive any adult learning. When training definition is taken into account, some papers (i.e. Bassanini et al. 2007) show that being female is associated with a higher probability of being involved in training. Arulampalam et al. (2004) find these results in 4 countries; conversely, in the other 6 countries there is not a significant difference between males and females. No differences are also founded by OECD (2003). On the opposite side, Pischke (2001) estimates that men in Germany are more likely to access to training. When considering a broader learning activity, Drewes (2008) finds that female are more likely to participate in educational programmes, but less likely to take training courses. For UK, in Jenkins et al. (2002) females are six

[5] See in particular Arulampalam et al. (2004) and Bassanini, et al. (2007) among studies using (dissimilar) concepts of training and Ok and Tergeist (2003), Drewes (2008), Jenkins et al. (2002), Sargant et al. (1997) among those defining a more general concept of lifelong learning

percentages points more likely to undertake lifelong learning, even though Sargant et al. (1997) show that men are more likely to be involved in training and education. Also Simonsen and Skipper (2008) find that men and women have different enrollment patterns: women are more likely to attend basic or post-secondary training courses, whereas men are more likely to get enrolled in vocational courses. However, despite current literature clearly shows observed gender differences, only Arulampalam et al. (2004) estimate separate cross-country equations for men and women to evaluate training participation.

The paper here attempts to address all three of these questions. To the best of our knowledge, this research is unique in comparing a quite large number of European Countries (21) by using separate equations for men and women with respect to incidence in lifelong learning inequality[6].

3. The data

Our data are from the 2005 first wave, of the European Union Statistics on Income and Living Conditions (EU-SILC), the new homogenized panel survey that has replaced ECHP, and actually covers EU25 (old and new) member states. Similarly to ECHP, EU-SILC is an attractive source of information because it adopts the same "community" questionnaire used by the national data collection units in each included country, which obviously makes comparisons across nations easier. Furthermore, EU-SILC actually covers a larger and increasing number of European countries with respect to the ECHP.

Each wave includes a household and a personal file. In the 2005 wave 197,657 nationally representative households and 422,040 individuals from EU-25 countries were interviewed.

In the table 1 we show LLL inequality in Europe. It is reported, by country and gender, the percentage of individual aged between 16 and 64 interviewed in 2005, who were involved in current learning scheme. The percentage of people undertaking LLL is a little higher among women than among men. The countries with the lowest percentages are Italy, Austria and Greece, while Slovenia, Germany, Lithuania and Finland show the highest values.

[6] The countries are: Belgium, Denmark, Germany, Greece, Spain, France, Italy, Luxembourg, Nederland, Austria, Portugal, Finland, United Kingdom, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Slovak Republic, Slovenia.

[Table 1 here]

In our study we only consider workers aged between 16 and 64, who are employed full or part-time according to their current self defined economic status. Thus, we choose to drop unemployed and retired individuals[7], pupils, students, people with unpaid work experience, permanently disabled or/and unfit to work, people in compulsory military community or service, those fulfilling domestic tasks and caring responsibilities and other inactive persons.

The observed dependent variable (the life-long learning LLL variable) is binary, taking value one if the individual is currently involved in some learning (education or training) programme defined under ISCED-97 as *"an array or sequence of educational activities, which are organised to accomplish a pre-determined objective or a specified set of educational tasks*" (UNESCO, 1999, p. 5). Unfortunately we cannot observe the specific typology of learning because this variable covers regular education and training systems which are normally intended to lead to a certification recognised by national authorities qualifying for a specific education/programme[8]. All we can observe with these data is whether or not an individual participates in any formal adult learning process, over its own working-life cycle. Thus, similarly to Simonsen and Skipper (2008) and Drewes (2008), we empirically identify lifelong learning as education and training formal enrollment over the entire working life-cycle.

4. Lifelong learning incidence

We start our empirical investigation by estimating a probit model for incidence of lifelong learning in 2005 across European countries

[7] Early retired too are included in this definition: consequently they have been kept out of this empirical survey.

[8] The individual's participation in this programme may be on a full-time attendance basis, a part-time attendance basis or by correspondence. The variable also includes modules (short programmes/courses) which may be part of a longer regular education programme and are taken and completed, giving to their graduates the corresponding academic credit, independent of whether the person continues to complete the full programme or not. The level of the short programmes/courses will be the same as the programme of which they form part. Furthermore, if the interviewed individual is enrolled as a student or an apprentice in a programme within the regular education system the answer will be 1. For apprentices who are in a period of only 'on-the-job training' or alternate 'on-the-job' and 'in-school learning' within the framework of an alternate (e.g. dual) programme, the answer is coded 1 as well, since the person is enrolled in a qualifying programme. The following adult programmes can not be classified using ISCED-97: i) vocational education organized by a firm without leading to an official award or certification ii) any non-formal education without leading to an official award or certification iii) individual cultural activities for leisure.

$$\Pr ob\,[T=1] = \Phi(Z'\,\beta) \qquad (1)$$

where Z is a set of explanatory variables, β is a vector of parameters and Φ is the standard normal distribution. In the regressions we include among the explanatory variables: age (*age*) and squared age (*age2*[9]); a dummy for marital status (*Idmarit* which equals 0 for workers who were never married, or got separated, widowed or divorced in 2005, and 1 if they were married in 2005); a dummy for the level of education attained (*Idpasted*=0 for workers with at most upper secondary education, 1 at least post secondary non tertiary education). All these variables are included in the individual-specific group. More specifically marital status and the level of education attained can be determined by the respondent, while the other regressors of that group cannot be controlled by her/him. Further, we insert a dummy for self defined current economic status (*full*, taking value 0 for individuals working full time, and 1 if they work part time), another for the type of contract (*perm* which equals 0 if workers signed a permanent contract, and 1 if they signed a temporary one[10]) and a third

[9] As is well known from the classical econometrics, the squared of continuous independent variables is a method to control for possible non linear relations between the dependent and the squared regressors.

[10] EU-SILC makes clear that in the majority of Member States most jobs are based on written work contracts. However in some countries such contracts exist only for specific cases (for example in the public sector, for apprentices, or for other persons undergoing some formal training within an enterprise). Taking account of these different institutional arrangements the notions "temporary job" and "work contract of limited duration" (likewise "permanent job" and "work contract of unlimited duration") describe situations which under different institutional frameworks can be regarded as similar. A job may be regarded as temporary if it is understood by both employer and the employee that the termination of the job is determined by objective conditions such as reaching a certain date, completion of an assignment or return of another employee who has been temporarily replaced. In the case of a work contract of limited duration the condition for its termination is generally mentioned in the contract. To be included in these groups are: i) persons with a seasonal job ii) persons engaged by an employment agency or business and hired out to a third party for the carrying out of a "work mission" (unless there is a work contract of unlimited duration with the employment agency or business) iii) persons with specific training contracts. If there exists no objective criterion for the termination of a job or work contract these should be regarded as permanent or of unlimited duration. What is involved is the actual employment being time-limited under an agreement - not that he/she has, for example, considered stopping work in order to travel or attend college. Respondents who have a contract to do their job, which may be renewed, for example, once a year, should be coded according to whether or not the respondents themselves consider their job to be of an unlimited duration.

one for recent job changes (*jobchng* which equals 0 if workers did not change job since last year, 1 otherwise). These three dummies are included in the job-specific group. Finally we build two dummies for the local unit's size (_*Iduns*=0 if the local unit has between 0 to 10 persons, 1 between 11 to 49, 2 if in the local unit there are 50 persons and more) and one for the type of worker's occupation (*hs*=0 if un-skilled occupation, 1 skilled). These are included in the firm specific group.

The summary statistics of these variables are shown in table 2. Some of these need a better explanation, with regard to EU-SILC definitions. The *full* variable captures the person's own perception of their main activity at present. It differs from the ILO concept to the extent that people's own perception of their main status differs from the strict definitions used in the ILO definitions. For instance, many people who would regard themselves as full-time students or homemakers may be classified as ILO-employed if they have a part-time job. Similarly, some people who consider themselves 'unemployed' may not meet the strict ILO criteria of taking active steps to find work and being immediately available. The self-declared main activity status is, in principle, determined on the basis of the most time spent, but no criteria have been specified explicitly. The distinction between full-time and part-time work should be made on the basis of a spontaneous answer given by the respondent. It is impossible to establish a more exact distinction between part-time and full-time work, due to variations in working hours between Member States and also between branches of industry. By checking the answer with the number of hours usually worked, it should be possible to detect and even to correct implausible answers, since part-time work will hardly ever exceed 35 hours, while full-time work will usually start at about 30 hours.

[Table 2 here]

The "local unit" to be considered is the geographical location where the job is mainly carried out or, in the case of itinerant occupations, can be said to be based; normally it consists of a single building, part of a building, or, at the largest, a self-contained group of buildings. The "local unit" is therefore the group of employees of the enterprise who are geographically located at the same site[11].

The *h-s* (highly skilled) variable refers to the main job (current main job for people at work or last main job for people who do not have a job). If multiple jobs are held or were held,

[11] Detailed information about EU-SILC definition of local unit are reported in the annex 1.

the main job should be the one with the greatest number of hours usually worked. The variable is coded according to the ISCO-88 (COM) classification provided in annex 2, which is based upon ISCO-88. In this paper we identify as un-skilled the occupations between 1 to 34 in the ISCO-88 classification, while the occupations between 41 to 93 are regarded as skilled.

4.1 The whole sample: men and women

Initially, we present the results of modelling the decision to undertake formal life-long learning as we defined it. Tables 3 and 4 report the whole sample estimates of the model for men and women respectively. As we have already outlined, the model is a standard probit, and the table shows the marginal effects (computed at the mean values of the regressors) measuring the change in the probability of formal LLL for an infinitesimal change in each independent, continuous variable and the change in the probability for discrete changes in dummy variables measured with respect to the base.

[Tables 3 and 4 here]

In general we find that individual characteristics are statistically significant predictors of the start of education and training activity, although the magnitude of the effects is relatively small: the results show that young, better educated and unmarried workers are more likely to receive formal LLL. By examining job characteristics, workers with temporary and part time contracts, and who did not change job in the last year show a significant higher probability to get in adult learning. Firm specific characteristics as well are relevant because workers in small local units and in low-skilled sectors are less likely to undertake formal LLL. The relationship between unit size and learning probability is also monotonic: the predicted probability to get in LLL is, in particular, higher for workers in large local units with respect to workers in medium local units. It should be also noted that being a part-time and temporary employee and having a skilled occupation are the features with the strongest effects. For example, workers (both men and women) with a temporary contract have an almost 6 percentage point higher probability of undertaking life-long learning, than the base group of permanent workers.

When examining gender differences, some particularities are obtained. We find that, changes in the probability of formal LLL for an infinitesimal change in each independent are

generally stronger among men; the only exception is the past education which shows a stronger effect among women. Furthermore, marital status and medium unit explanatory variables are not significant respectively amongst men and women.

4.2 Differences across European countries: men and women

We report our reduced form estimates for each of the 21 European countries in tables 5 and 6 for men and women respectively.

[Tables 5 and 6 here]

Personal characteristics

The theory of human capital predicts that younger workers enjoy a greater learning opportunity since the learning investment shows a longer life cycle. The results across countries demonstrate that the probabilities of taking formal LLL decline with age in Austria, Germany, France, Greece and Latvia for both men and women. Young male workers are also more likely to receive LLL in Denmark, Italy, Lithuania and the Netherlands for men while young employed females have an higher probability to get LLL in Belgium, Spain and United Kingdom.

Marital status variable confirms its stronger relevance amongst women by also controlling for cross-country differences. As to men, being unmarried in 2005 is associated to a higher probability to be involved in LLL only in Spain, while in Austria, Czech Republic, Germany, Estonia, Spain, Finland, Hungary, Italy, Latvia, Nederland, Portugal and Slovenia married women are less likely to receive LLL with respect to the unmarried women (i.e. the base group). The only exception is found for Latvia's male workers, who enjoy higher learning probability when married.

As we noted above, there is a strong evidence in the current economic literature about complementarity between past education and adult learning and about relevant idiosyncratic elements across European countries. Our results clearly show that past education is the explanatory variable with the most significant heterogeneity across countries: in fact, in some of them the complementarity between highest level of education attained and current learning is confirmed, while in other countries complementarity is not significant. In a few countries the probability to get adult learning is higher among less educated workers. As to men, Austria, Spain, France and Slovenia corroborate the results for the entire sample:

workers with at least post secondary education have a higher probability to be involved in LLL than workers with at most upper secondary education. The same situation emerges in Austria, Germany and Spain for women. Conversely, in Finland, Latvia and Denmark, and in Finland, Hungary, Lithuania and United Kingdom, for men and women respectively, less educated workers are more likely to undertake formal LLL.

A couple of results are quite interesting with regard to Scandinavian countries. First, Finland is the only country in the sample where, for both men and women, higher education reduces the incidence of formal LLL. Second, Denmark is the only country where, for women, being less educated is the most relevant variable for increasing the probability of undertaking adult formal learning scheme: Danish women with at most upper secondary education have a 4.6 percentage point higher probability to get in adult formal learning course, than women with at least post secondary education. According to Simonsen and Skipper (2008) this particular result confirms that Denmark is a very special country with regard to training schemes.

Job characteristics

The results show that in ten countries for men and eleven countries for women, workers with a part-time contract are significantly more likely to get LLL than the base group of those with a full-time contract. For both sexes the common set of countries comprises Spain, Finland, Italy, Latvia and Portugal. Further, men with a part-time contract in Austria, Germany, France, the Netherlands and United Kingdom, and women in Cyprus, Czech Republic, Estonia, Greece, Hungary and Lithuania have a higher probability to undertake adult learning. Also workers with a temporary contract are associated to a higher probability of LLL than the base group of permanent workers, for both sexes, in Austria, Belgium, Germany, Finland and France. Nevertheless women with a temporary contract in Czech Republic, Lithuania and the Netherlands, and men in United Kingdom are also more likely to get in LLL.

The negative correlation between training and turnover is a widespread idea in the economic literature. Nonetheless we find a weak evidence with regard to formal LLL, as changing job in the last year is negatively and significantly associated with adult learning in just a few European countries. We find that workers who changed job in the last year are less likely to receive adult learning for both sexes only in Germany and France. For men it also holds in Denmark, Greece, the Netherlands and the Slovak Republic. Consequently, while in the whole sample male and female workers who recently changed their own job get

significantly less adult learning, that evidence disappears in the majority of European countries when 21 country-specific probit regressions are performed for the two sexes, i.e. when specific country and sex effects are taken into account.

Firm characteristics

Not differently from the current economic literature our cross-countries estimates substantially confirm the results obtained for the whole sample: in many countries, the larger the local unit, the higher the probability to be involved in adult learning. The only exceptions are Denmark (where for both men and women workers in medium local units are less likely to receive adult learning than the base group of workers in small local units) and Luxembourg where this result is found only for women.

Nevertheless, the significance of the coefficients is not strong at all. More precisely, for the two sexes, working in a large local unit significantly increases the probability of undertaking formal LLL with respect to the base group of small units in Spain and Latvia; for men in Finland, Greece and the Netherlands; for women in Cyprus and Italy. As for medium units, the increase in probability to get adult learning is significant in Denmark, Greece and Latvia for men and Denmark, Spain, France, Luxembourg, Slovak Republic for women, with the highest increase in probability found for greek males working in medium local units and latvian and spanish females employed in large local units..

The most homogeneous result is found for the type of occupation. For both sexes, workers engaged in high-skilled occupations are more likely to undertake formal LLL than the base group of workers in low-skilled jobs in ten countries: Czech Republic, Estonia, Spain, Finland, Hungary, Italy, Lithuania, Latvia, Slovenia and Slovak Republic. Men getting highly skilled occupations are also more likely to get adult learning in Cyprus, Germany, Portugal; women in Greece and the Netherlands.

5 Heteroscedasticity due to sex

Next, we control for possible heteroscedasticity of error variance across groups which may cause parameter estimates to be biased, inconsistent and inefficient (Yatchew and Griliches 1985).

Recently, Arulampalam et al. (2003) in a panel data framework, after the estimation of a RE model, use a Bayesian framework to estimate for each individual of each gender the unobserved individual specific component.

Here we take a different route, partly compelled by the cross-sectional nature of our data Indeed, as is well known in a probit model the residual variance is assumed to be Var(ε)=1 while in the logit model it is set to $\pi^2/3$. That means in binary regression models coefficients are inherently standardized. More precisely, while in the OLS model the standardization is carried out by rescaling all variables to have a variance of 1, in a probit or logit model the standardization is accomplished by scaling the variables and residuals so that the residual variances are 1 or $\pi^2/3$ (Long and Freese 2006):

$$\Pr(y_i = 1) = \Phi\left(\frac{x_i\beta}{\sigma}\right) \tag{2}$$

If (as it is normally assumed) σ=1 we get the usual (homoscedastic) probit. But if we are in presence of heteroscedasticity in the residual variance, a problem arises in modelling a possible equation variance to get rid of biases in the estimates.

Thus, following Alvarez and Brehm (1995) we model the following equation to account for a possible heteroscedasticity:

$$\Pr(y_i = 1) = \Phi\left(\frac{x_i\beta}{\exp(z_i\gamma)}\right) \tag{3}$$

where $\exp(z_i\gamma) = \sigma_i = f(z_i)$ and z's are a set of regressors.

In table 7, we report the results for a) the homoscedastic un-weighted form; b) the homoscedastic weighted specification; c) the heteroscedastic model. The second differs from the first in using the inverse of the probability for an individual to be included in the sample due to the survey design. In the third – following Allison (1999) - a variance equation $\sigma_i = \exp(sex_i\gamma)$ only depending on the sex variable is built up: indeed, unmeasured variables affecting life-long learning decisions may be strongly affected by gender differences[12].

[Table 7 here]

The results show that, on the one hand, in the homoscedastic weighted specification (see table 6, column 2) there is no huge change in any explanatory variable compared to the homoscedastic un-weighted model (see tables 6, column 1) except for the sex variable which

[12] The more heterogeneous career patterns for women is a widely recognised fact in the labour economics and econometrics (see for instance Allison 1999, Williams 2009). That is to say unmeasured variables affecting LLL may be more important for women than for men.

becomes statistically un-significant. On the other hand, while no variation can be noted in any other regressor, the corresponding sign for sex on the heteroscedastic model becomes negative and quite significative with respect to the homoscedastic weighted specification (see table 5, column 3).

6. Conclusions

Human capital is a dynamic process concerning skill formation (Carneiro and Hechman 2003). Its accumulation is a continuous process, which involves different stages of the life cycle, starting at school keeping on spreading out during working life through adult learning.

As a matter of fact,, life-long learning actually remains a key goal for education and training policies in OECD countries, because people, in a period with fast changing technologies, need to update their skills throughout their working lives (OECD 2007).

The primary purpose of this paper has been to explore the potential for EU-SILC data to deepen our understanding of the determinants of inequality in workers' formal life-long learning in Europe. In particular we have investigated the incidence of personal, job-specific and firm-specific characteristics on the workers' probability to undertake adult learning. To do so, first we have estimated the LLL incidence in the whole sample of 21 European countries with separate equations for men and women. Then we have estimated 21 country-specific equations, also for both sexes. This method allows to investigate cross-country gender differences and avoid unobserved heteroscedasticity due to sex, which we clearly find in the data.

Some common findings about adult education and training found in the literature are also found in the EU-SILC data. For the whole sample the results show that, for both men and women, formal LLL incidence is significantly higher among young and better educated workers, and lower among workers who changed current job in the last year and are involved in small firms and in low-skilled occupations.

The estimates also clearly demonstrate, for both sexes in the whole sample, that part-time and temporary workers are significantly more likely to undertake formal LLL. Moreover these two explanatory variables have the strongest effect on the probability of further adult learning.

Some gender differences for the whole sample emerge. First, the effect of the explanatory variables is stronger amongst men: the only exception is the level of attained education, which shows a stronger effect amongst females. Second, marital status and medium unit explanatory variables are not significant amongst men and women respectively.

When estimating separate equations for each country and for both sexes, a significant cross-country heterogeneity is found. Among personal characteristics, the incidence of adult learning programmes declines with age in eight countries amongst men and seven countries amongst women respectively.

Marital status explanatory variable confirms its stronger relevance among women by also controlling for cross-country differences. Being single in 2005 is associated to a higher probability to get in LLL only in Spain for men, and in twelve countries for women. The only exception is found for Latvia's men, who show a higher learning probability when married.

As for job characteristics we find that in ten countries for men and eleven countries for women, workers with a part-time contract are significantly more likely to get LLL than those with a full-time contract. Moreover, this result is found for both sexes in five countries. Workers with a temporary contract are associated to a higher probability of LLL than permanent workers, for both sexes, in other five countries, three countries for women and one country (UK) for men.

The significance of the (negative) coefficient of the dummy variable of having recently changed job is found for both sexes only in two countries (Germany and France) and in other four smaller countries for men.

As for firm characteristics, the country specific probit regressions confirm the results achieved for the whole sample with a few small exceptions: that is, large units are usually related to a higher probability for workers to get adult learning than medium and small firms with a monotonic relation between probability and unit size. Once we examine the country disaggregated results, we find a weaker significance of the positive coefficients associated to medium and large units as usual. The strongest homogeneity is found for high skilled occupations which seems to increase the probability of adult learning in at most fifteen countries.

Focusing on the relation between the probability of getting LLL and the level of the past attained education, for the whole sample of European Countries, EU-SILC data confirm that the more educated you are at the end of the school age, the more likely you will or are allowed to go back to learning and obtain another qualification during working life: those who have already completed at least some post-secondary non tertiary education enjoy a greater learning opportunity than those with upper secondary education or less. Looking at a national level, a couple of relevant results emerge for Scandinavian countries. Finland is the only country in the sample in which, for both men and women, less educated workers are more

likely to undertake formal LLL, thus making adult learning system able to avoid, for both sexes, existing inequality in human capital as it results from education levels. Denmark is the only country where, for women, being less educated constitutes the predictor with the greatest significant magnitude of the effect on the variation in probability.

When we consider the most likely source of heteroscedasticity for the whole sample (i.e. when we model a variance equation depending on the sex variable as suggested by the literature), and compare the results with the homoscedastic weighted and un-weighted models we find that the coefficient first becomes not significant in the weighted homoscedastic form, then gets a negative and significant sign in the heteroscedastic one.

References

Allison, Paul. 1999. “Comparing Logit and Probit Coefficients Across Groups.” Sociological Methods and Research 28(2): 186-208.

Alvarez, R. Michael and John Brehm. 1995. “American Ambivalence Towards Abortion Policy: Development of a Heteroskedastic Probit Model of Competing Values." American Journal of Political Science 39:1055-1082.

Ariga, K. and Brunello, G. (2006), Are More Educated Receiving More Training? Evidence from Thailand, Industrial and Labour Relations Review, 2006, 59 (4), 613-629

Arulampalam, W., Booth, A. and Bryan, M. (2004), Training in Europe, Journal of the European Economic Association, 2 (2-3), pp. 346-360.

Asplund, R. (2004), The Provision and Effects of Company Training: A brief review of the literature, ETLA Discussion Paper no. 907

Bassanini A. (2004), Improving Skills for More and Better Jobs? The Quest for Efficient Policies to Promote Adult Education and Training, presented at the Conference on Quality and Efficiency in Education, Brussels, May.

Bassanini, A. Booth, A. L., Brunello, G., De Paola, M. and Leuven, E., (2007) Workplace Training in Europe, in: Brunello, Garibaldi and Wasmer (eds.), Education and Training in Europe, Oxford University Press, 2007, Ch. 8 - 13

Brunello, G. (2003), On the Complementarity between Education and Training in Europe, in Checchi and Lucifora, (eds.), Education, Training and Labour Market Outcomes in Europe, Palgrave, McMillan.

Brunello G. and Medio A. (2001), An Explanation of International Differences in Education and Workplace Training, European Economic Review, vol.1, pp.307-322.

Carneiro, P. and Heckman, J. J., (2003) "Human Capital Policy," IZA Discussion Papers 821, Institute for the Study of Labour (IZA).

Drewes, T. (2008) Adult Education and Training from a Longitudinal Perspective, Trent University, march 2008

EUROSTAT (2005), The continuity of indicators during the transition between ECHP and EU-SILC

Jenkins, A., Vignoles, A., Wolf, A., Galindo-Rueda, F. (2002) The determinants and effects of lifelong learning. CEEDP, 19. Centre for the Economics of Education, London School of Economics and Political Science, London, UK.

Long, J. Scott and Jeremy Freese. 2006. “Regression Models for Categorical Dependent Variables Using Stata, Second Edition.” College Station, Texas: Stata Press.

OECD (1999), Employment Outlook, Paris.

OECD (2001), The Economics and Finance of Lifelong Learning, Paris.

OECD (2007), Qualifications Systems. Bridges to Lifelong Learning, Paris.

Ok W. and Tergeist, P. (2003), Improving Workers’ Skills: Analytical Evidence and the Role of the Social Partners, OECD Social, Employment and Migration Working Papers.

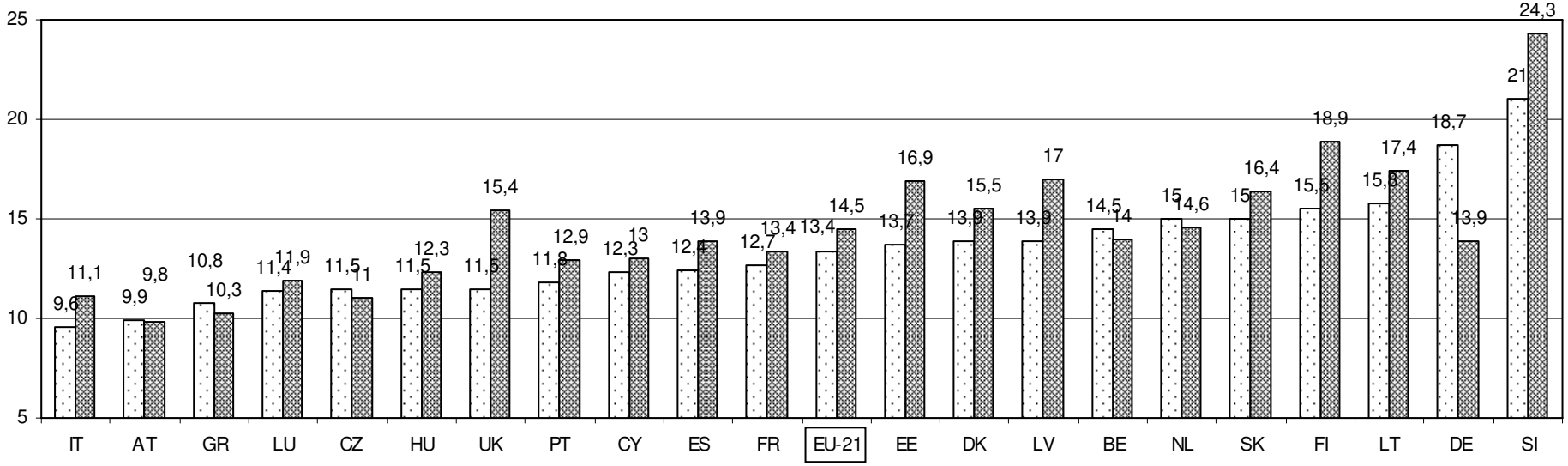
Sargant, N., Field J., Francis, H., Schuller, T. and Tuckett, A. (1997), The Learning Divide: A Study of Participation in Adult Learning in the United Kingdom, NIACE.

Simonsen, M. e Skipper, L. (2008) The Incidence and Intensity of Formal Lifelong Learning, Economics Working Papers 2008-07, School of Economics and Management, University of Aarhus.

Yatchew, A. and Z. Griliches. 1985. “Specification Error In Probit Models." Review of Economics and Statistics 18:134-139.

Williams R. 2009. “Using Heterogeneous Choice Models to Compare Logit and Probit Coefficients across Groups”.

Tab 1. Life-long learning participation across European countries for men and women. Persons aged 16-64



Observations are weighted by EU-SILC personal cross-sectional weights which account for non-random sample selection due to the survey design. The statistics can therefore be taken as representative of each country's population.

Table 2. summary statistics of the variable in the LLL regression. 21 countries in 2005

Variable	Obs	Mean	Std. Dev.	Min	Max
LLL	194280	.0542825	.2265748	0	1
age	197500	41.30235	11.12841	16	64
marit	197500	.6286684	.4831621	0	1
pasted	193989	.319549	.4663031	0	1
full	195638	.1385007	.3454256	0	1
perm	135661	.1410649	.3480897	0	1
jobchng	131105	.0823691	.2749273	0	1
dunsize	167173	.9422514	.8553833	0	2
hs	193734	.3983813	.489566	0	1

Table 3: LLL Probit for selected variables in the whole sample. Marginal effects for men

Number of obs = 54796
Wald chi2(10) = 1781.35
Prob > chi2 = 0.0000
Log pseudolikelihood = -8962.3322 Pseudo R2 = 0.2331

LLL	dF/dx	Robust Std. Err.	z	P>|z|	x-bar	[95% C.I.]	
age	-.0123775	.000637	-20.38	0.000	39.8957	-.013626	-.011129
age2	.0001222	7.75e-06	16.31	0.000	1710.6	.000107	.000137
Idmarit*	.0014213	.0027921	0.51	0.613	.597988	-.004051	.006894
Idpasted*	.006174	.0027978	2.29	0.022	.320268	.00069	.011658
full*	.036945	.0073052	6.65	0.000	.045599	.022627	.051263
perm*	.0595479	.0050681	16.24	0.000	.136023	.049615	.069481
jobchng*	-.0155118	.0023704	-5.10	0.000	.091078	-.020158	-.010866
_Iduns~1*	.0064059	.0031228	2.13	0.033	.285827	.000285	.012526
_Iduns~2*	.0127372	.0028641	4.53	0.000	.471069	.007124	.018351
hs*	.0247673	.002995	8.80	0.000	.377345	.018897	.030637
obs. P	.0550992						
pred. P	.0291627	(at x-bar)					

(*) dF/dx is for discrete change of dummy variable from 0 to 1. Observations are weighted by EU-SILC personal cross-sectional weights. Other controls included but not reported are dummies for managerial position and health.

Table 4: LLL Probit for selected variables in the whole sample. Marginal effects for women

Number of obs = 48792
Wald chi2(10) = 1412.19
Prob > chi2 = 0.0000
Log pseudolikelihood = -9136.8801 Pseudo R2 = 0.1775

LLL	dF/dx	Robust Std. Err.	z	P>|z|	x-bar	[95% C.I.]	
age	-.0115051	.0008162	-14.31	0.000	40.063	-.013105	-.009905
age2	.000109	.0000101	10.87	0.000	1718.11	.000089	.000129
Idmarit*	-.0168875	.0030305	-5.71	0.000	.549038	-.022827	-.010948
Idpasted*	.0083178	.0031734	2.71	0.007	.384882	.002098	.014538
full*	.0122319	.0032812	3.90	0.000	.300972	.005801	.018663
perm*	.0591167	.0052292	14.68	0.000	.15575	.048868	.069366
jobchng*	-.0107765	.0032763	-2.94	0.003	.092929	-.017198	-.004355
duns~1*	.0040678	.0033779	1.22	0.221	.28076	-.002553	.010688
duns~2*	.0064907	.0032724	2.01	0.045	.407403	.000077	.012905
hs*	.0240684	.0032474	7.55	0.000	.428269	.017704	.030433
obs. P	.0602608						
pred. P	.0372803	(at x-bar)					

Notes: see notes to Table 4.

Tab 5: LLL Probit for selected variables. Cross country analysis. Marginal effects for men

	AT	BE	CY	CZ	DE	DK	EE
age	-0.010326***	0.002222	-0.000357	-0.000276	-0.014037***	-0.008675**	-0.003136
age2	0.000110***	-0.000050	-0.000014	-0.000002	0.000128***	0.000080**	0.000017
Idmarit	-0.008689	-0.015676	0.005177	-0.000015	0.002630	-0.005503	-0.009722
Idpasted	0.029593***	0.012690	0.004980	0.004119	-0.007345	-0.003915	0.011211
full	0.042507**	0.032677	0.037425		0.032875*		0.036694
perm	0.063809***	0.045520**	0.000110	-0.002861	0.139013***		-0.003136
jobchng	-0.004584	0.010784	0.000024	0.006020	-0.020156***	-0.008555	0.013828
duns~1	0.000612	0.009102	-0.001252	-0.000592	-0.008402	-0.016070*	0.006853
duns~2	0.001686	0.003046	0.006079	-0.001005	0.002798	-0.004290	-0.000765
hs	0.008649	-0.004676	0.016387**	0.013137**	0.014056**	0.036366	0.040515***
N	2678	1998	2151	1814	5176	597	1924
pseudo R-sq	0.388	0.082	0.173	0.126	0.570	0.351	0.291

	ES	FI	FR	GR	HU	IT	LT
age	-0.001158	-0.004778	-0.006152***	-0.003049*	0.003346	-0.002867*	-0.005153*
age2	-0.000006	-0.000007	0.000064***	0.000024	-0.000069**	0.000029	0.000022
Idmarit	-0.017751*	0.007916	0.002550	-0.001338	-0.003463	-0.000482	-0.005094
Idpasted	0.024225**	-0.036633**	0.016742***	0.004731	0.010076	0.008075	-0.005656
full	0.087343***	0.288795***	0.026961**	0.030918	0.025205	0.047977***	0.002538
perm	-0.008912	0.043050*	0.052407***	0.015853	0.028830	0.008455	-0.002724
jobchng	0.019311	-0.006648	-0.013519***	-0.008035*	-0.005530	0.011323	-0.001273
duns~1	0.006532	0.013022	-0.001846	0.031871***	-0.009513	0.007659	-0.005494
duns~2	0.021222**	0.029936*	0.001521	0.027312*	-0.000889	0.006716	-0.004234
hs	0.057675***	0.097983***	-0.001255	0.009951	0.035421**	0.012598**	0.047992***
N	6092	2096	3693	1879	2363	8122	1812
pseudo R-sq	0.108	0.264	0.261	0.184	0.137	0.030	0.247

	LU	LV	NL	PT	SI	SK	UK
age	-0.000174	-0.008494***	-0.016674***	0.000472	-0.001886	0.001392	-0.007871*
age2	0.000002	0.000059**	0.000133***	-0.000033	-0.000070	-0.000033**	0.000086
Idmarit	-0.000065	0.019897**	0.012176	-0.006251	0.002631	0.001331	-0.004610
Idpasted	0.000099	-0.020202**	0.002711	0.013565	0.044453*	0.006279	0.010483
full	0.000192	0.077986*	0.100309***	0.118323*	-0.042903	0.024714	0.089656**
perm	0.001121	-0.003683	0.041597	-0.004525	-0.005058	0.011183	-0.032542**
jobchng	-0.000007	-0.002048	-0.035072**	-0.005559	-0.004158	-0.005955*	0.014186
duns~1	-0.000089	0.021089*		0.011661	0.009841	-0.000970	
duns~2	-0.000092	0.025949*	0.029237**	0.017410	0.021739	-0.001094	
hs	0.000786	0.123307***	0.009998	0.059588***	0.083976***	0.020916***	0.004777
N	1964	1509	2083	1662	1706	2822	627
pseudo R-sq	0.524	0.275	0.150	0.190	0.156	0.143	0.068

Significance: * p<0.10, ** p<0.05, *** p<0.01. Observations are weighted by EU-SILC personal cross-sectional weights.
Other controls included but not reported are dummies for managerial position and health.

Tab 6: LLL Probit for selected variables. Cross country analysis. Marginal effects for women

	AT	BE	CY	CZ	DE	DK	EE
age	-0.009140***	-0.006933*	0.001331	0.000454	-0.012040***	-0.007449	-0.003855
age2	0.000104***	0.000077	-0.000037	-0.000021	0.000113***	0.000029	0.000004
Idmarit	-0.020226***	-0.018881	-0.006877	-0.012927*	-0.018933***	-0.007040	-0.020769**
Idpasted	0.014449**	0.011883	-0.006892	-0.002754	0.012668**	-0.045709**	-0.011962
full	0.005485	0.016174	0.024661*	0.071863**	0.002774		0.071189**
perm	0.041893**	0.041355*	-0.005399	0.016467*	0.131088***		0.032111
jobchng	0.006557	-0.013014	-0.008084	-0.007594	-0.018191***	0.028975	0.033794
duns~1	0.007218	0.019757	0.011625	-0.002941	-0.004641	-0.033394*	0.018092
duns~2	0.000197	0.007079	0.017976*	0.001745	0.004189	-0.023109	0.000507
hs	-0.002423	-0.000916	0.013359	0.021954***	0.007295	-0.001904	0.057123***
N	2135	1774	1874	1629	5000	457	2081
pseudo R-sq	0.316	0.030	0.127	0.197	0.413	0.270	0.222

	ES	FI	FR	GR	HU	IT	LT
age	-0.010868***	-0.006817	-0.008926***	-0.004039*	0.000325	0.000162	-0.004701
age2	0.000104***	0.000008	0.000093***	0.000033	-0.000047	-0.000025	0.000003
Idmarit	-0.027886***	-0.036679**	-0.006396	-0.001020	-0.018294**	-0.019411***	-0.019629*
Idpasted	0.024228**	-0.029488*	0.004709	-0.010000	-0.014206*	0.006513	-0.032210**
full	0.053896***	0.119126***	0.008840	0.076874***	0.033150*	0.040460***	0.050959**
perm	0.009394	0.084580***	0.064438***	-0.006582	0.020051	0.009757	0.050054*
jobchng	-0.009087	0.001577	-0.014940***	-0.004701	0.000915	0.003085	0.034415
duns~1	0.028957**	-0.001126	0.020194**	-0.002800	-0.000533	0.006675	0.008293
duns~2	0.045227***	0.019947	0.009348	0.020084	-0.006920	0.015849**	0.007367
hs	0.066744***	0.064722***	0.010371	0.022421*	0.044938***	0.011055*	0.070382***
N	4430	2244	3660	1349	2311	6234	2019
pseudo R-sq	0.121	0.204	0.216	0.186	0.150	0.072	0.282

	LU	LV	NL	PT	SI	SK	UK
age	-0.000543	-0.017461***	-0.001063	0.003101	-0.002359	0.003351	-0.011134*
age2	0.000007	0.000133**	-0.000044	-0.000072*	-0.000103	-0.000071**	0.000113
Idmarit	-0.007896	-0.011803	-0.032239**	-0.025891**	-0.036105**	-0.004024	-0.034673
Idpasted	0.000819	-0.047305***	0.007859	0.022944	0.027101	-0.008155	0.047511*
full	-0.000583	0.109754**	-0.002472	0.086074**	-0.005745	-0.001851	0.000938
perm	0.009972	-0.013005	0.061690*	0.017696	-0.030423	0.004323	0.077953
jobchng	0.001750	0.005456	-0.026065	0.007499	0.066183	-0.003918	0.011611
duns~1	-0.001970*	0.023216	-0.023287	0.021704	0.026710	0.018217***	
duns~2	-0.000484	0.041165*		0.011041	-0.016098	-0.007039	
hs	0.000212	0.124633***	0.033487*	0.016618	0.084255***	0.032564***	0.010660
N	1444	1675	1611	1581	1615	2925	744
pseudo R-sq	0.419	0.209	0.087	0.176	0.154	0.112	0.068

Notes: see notes to Table 4.

Table 7. Heteroscedasticity due to sex. Un-weigheted homoscedastic model, weigheted homoscedastic model and heteroscedastic model

	homosk unw		homosk w		het-sex	
age	-0.11544***	(-25.80)	-0.15659***	(-26.07)	-0.16313***	(-23.55)
age2	0.00099***	(17.47)	0.00149***	(20.54)	0.00155***	(19.26)
sex	0.08447***	(5.64)	0.01767	(0.76)	-0.10838*	(-1.70)
Idmarit	-0.13761***	(-8.16)	-0.11033***	(-4.15)	-0.10622***	(-3.78)
Idpasted	0.03079*	(1.83)	0.09680***	(3.59)	0.10264***	(3.62)
full	0.23220***	(11.47)	0.20297***	(6.51)	0.21050***	(6.35)
perm	0.35046***	(19.32)	0.56486***	(22.21)	0.58791***	(20.54)
jobchng	-0.08719***	(-3.72)	-0.21904***	(-5.84)	-0.22817***	(-5.76)
duns~1	0.10157***	(5.38)	0.06648**	(2.26)	0.07023**	(2.29)
duns~2	0.11930***	(6.54)	0.13226***	(4.66)	0.14038***	(4.70)
hs	0.42313***	(25.46)	0.31199***	(11.56)	0.32651***	(11.33)
_cons	0.81148***	(10.07)	1.58272***	(14.29)	1.70375***	(13.39)
lnsigma2						
sex					0.08529**	(2.25)
N	104297		104297		104297	

Significance: * p<0.10, ** p<0.05, *** p<0.01.

Annex 1: The enterprise and local unit in EU-SILC

The Enterprise

The concept of enterprise is based on those of 'legal units' and 'institutional units'.

Combination of legal units

"The *enterprise* is the smallest combination of *legal units* [defined below] that is an organisational unit producing goods and services, which benefits from a certain degree of autonomy in decision-making, especially for the allocation of its current resources..... An enterprise may be a sole legal unit." However, under certain circumstances, it can "correspond to a grouping of several legal units. Some legal units, in fact, perform activities exclusively for other legal units and their existence can only be explained by administrative factors (e.g. tax reasons), without them being of any economic significance. A large proportion of the legal units with no persons employed also belongs to this category. In many cases the activities of these legal units should be seen as ancillary activities of the parent legal unit they serve, to which they belong to which they must be attached to form an enterprise used for economic analysis.

Hence to constitute the enterprise unit, use is made of legal units that exercise, wholly or partially, a productive activity. *Legal units* include: "legal persons whose existence is recognised by law independently of the individuals or institutions which may own them or are members of them"; and "natural persons who are engaged in an economic activity in their own right". The legal unit always forms, either by itself or sometimes in combination with other legal units, the legal basis for the statistical unit known as the 'enterprise'.

Institutional units.

"In the corporate enterprises sector, the enterprise corresponds to the institutional units used in the ESA. Similar institutional units also exist in the general government and private non-profit institutions sectors". Here, the *institutional unit* refers to "an elementary economic decision-making centre characterised by uniformity of behaviour and decision-making autonomy in respect of its principal function. A unit is regarded as constituting an institutional unit if it has decision-making autonomy in respect of its principal function and keeps a complete set of records". This includes public and private companies and public corporations; agencies of general government; and co-operatives or partnerships, public enterprises, non-profit institutions etc., recognised as independent legal entities. Also included are other quasi-corporate enterprises (sole proprietorships and other partnerships and public enterprises) "in so far as their economic and financial behaviour can be separated from that of their owners and resembles that of corporate enterprises". Household enterprises - not necessarily keeping a complete set of accounts but by convention deemed to have autonomy of decision - also form institutional units. The institutional unit in the household sector covers all activities of households, while the term 'enterprise' is reserved exclusively for their production activities.

Classification by principal activity

Units such as enterprises or 'local units' are classified in terms of their *economic activity of production.* An 'activity' takes place when "resources such as equipment, labour, manufacturing techniques, information networks of products are combined, leading to the creation of specific goods or services." An activity is characterised by "an input of products (goods and services), a production process and an output of products", and is classified by reference to a specific level of NACE (REV 1.1) Rev.1.

If a unit carries out more than one activity, the following procedure applies to its classification. A distinction is made between *principal activity* and *secondary activities.* For this purpose "all the activities which are not ancillary activities are ranked according to the gross value-added at factor cost which they generate... If no value-added figures are available, other criteria must be used, such as, for example, employment, payroll, turnover and assets, with a view to obtaining the closest possible approximation to the classification which would have been obtained on the basis of value-added.... If one activity accounts for over 50% of the value added this determines the classification of the unit. In all other cases ... classification is carried out in stages from the highest level of aggregation... [and] at each level

[it] must be compatible with the previous level". In the EU-SILC, information is sought on the nature of economic activity of the local unit only to the second digit level (section and division) of the classification.
Principal and secondary activities are "backed up by *ancillary activities*, such as, for example, administration, accounts, data processing, process monitoring, purchasing, sales and marketing, ware housing, repairs, transport and renovation. These ancillary activities within a unit are carried out in order to permit or facilitate production by the unit of goods and services for third parties." The products of ancillary activities do not generate gross fixed capital formation nor normally form part of the unit's end product, and are not themselves supplied to third parties. Examples of ancillary activities include production of small implements for the unit's use, own-account transport, sales of own products, or administrative department of an enterprise. For the purpose of classification according to type of activity of the enterprise or other economic unit, the general rule is that "the ancillary activity is not taken into account when classifying the activity of the entity by which the ancillary activities are carried out".
The concept of principal activity applies to any level of units. The EU-SILC seeks information at the *level of the local unit*, as defined below. In the case of a local unit engaged only in ancillary activity, its activity classification is determined by the principal activity of the unit or units it serves in the enterprise.

The Local Unit

An enterprise carries out one or more activities at one or more locations. The *local unit* is "an enterprise or part thereof (e.g. a workshop, factory, warehouse, office, mine or depot) situated in a geographically identified place. At or from this place economic activity is carried out for which - save for certain exceptions - one or more persons work (even if only part-time) for one and the same enterprise." Further explanatory rules include the following.

- A geographically identified place is interpreted on a strict basis: two units belonging to the same enterprise at different locations (even within the smallest administrative unit of the Member State) are regarded as separate local units.
- If a person works in more than one place or at home, the local unit is taken to be place from which instructions emanate or from where the work is organised.

The concept of local unit relates to the operational definition of the *establishment* in ISIC Rev.3 as follows. A single local unit may carry out, at a single location, more than one kinds of activities. The operational definition of the establishment corresponds to the *local kind-of-activity unit (local KAU)*, i.e. the part of the enterprise KAU which corresponds to a local unit. As to the definition of enterprise KAU, it "groups all the parts of an enterprise contributing to the performance of an activity at class level (four digits) of NACE (REV 1.1) Rev. 1 and corresponds to one or more operational subdivisions of the enterprise".

Annex 2. ISCO-88 (COM). International Standard Classification of Occupations

Legislators, senior officials and managers

11 Legislators, senior officials and managers
- Legislators and senior government officials
- Senior officials of special-interest organisations

12 Corporate managers
- Directors and chief executives
- Production and operations managers
- Other specialist managers

13 Managers of small enterprises
- Managers of small enterprises

Professionals

21 Physical, mathematical and engineering science professionals
- Physicists, chemists and related professionals
- Mathematicians, statisticians and related professionals
- Computing professionals
- Architects, engineers and related professionals

22 Life science and health professionals
- Life science professionals
- Health professionals (except nursing)
- Nursing and midwifery professionals

23 Teaching professionals
- College, university and higher education teaching professionals
- Secondary education teaching professionals
- Primary and pre-primary education teaching professionals
- Special education teaching professionals
- Other teaching professionals

24 Other professionals
- Business professionals
- Legal professionals
- Archivists, librarians and related information professionals
- Social science and related professionals
- Writers and creative or performing artists
- Religious professionals
- Public service administrative professionals

Technicians and associate professionals

31 Physical and engineering science associate professionals
- Physical and engineering science technicians
- Computer associate professionals
- Optical and electronic equipment operators
- Ship and aircraft controllers and technicians
- Safety and quality inspectors

32 Life science and health associate professionals
- Life science technicians and related associate professionals
- Health associate professionals (except nursing)
- Nursing and midwifery associate professionals

33 Teaching associate professionals
- Primary education teaching associate professionals
- Pre-primary education teaching associate professionals
- Special education teaching associate professionals
- Other teaching associate professionals

34 Other associate professionals
- Finance and sales associate professionals
- Business services agents and trade brokers
- Administrative associate professionals

- Customs, tax and related government associate professionals
- Police inspectors and detectives
- Social work associate professionals
- Artistic, entertainment and sports associate professionals
- Religious associate professionals

Clerks

41 Office clerks
- Secretaries and keyboard-operating clerks
- Numerical clerks
- Material-recording and transport clerks
- Library, mail and related clerks
- Other office clerks

42 Customer services clerks
- Cashiers, tellers and related clerks
- Client information clerks

Service workers and shop and market sales workers

51 Personal and protective services workers
- Travel attendants and related workers
- Housekeeping and restaurant services workers
- Personal care and related workers
- Other personal services workers
- Protective services workers

52 Models, salespersons and demonstrators
- Fashion and other models
- Shop, stall and market salespersons and demonstrators

Skilled agricultural and fishery workers

61 Skilled agricultural and fishery workers
- Market gardeners and crop growers
- Animal producers and related workers
- Crop and animal producers
- Forestry and related workers
- Fishery workers, hunters and trappers

Craft and related trades workers

71 Extraction and building trades workers
- Miners, shotfirers, stone cutters and carvers
- Building frame and related trades workers
- Building finishers and related trades workers
- Painters, building structure cleaners and related trades workers

72 Metal, machinery and related trades workers
- Metal moulders, welders, sheet-metal workers, structural-metal preparers, and related trades workers
- Blacksmiths, tool-makers and related trades workers
- Machinery mechanics and fitters
- Electrical and electronic equipment mechanics and fitters

73 Precision, handicraft, craft printing and related trades workers
- Precision workers in metal and related materials
- Potters, glass-makers and related trades workers
- Handicraft workers in wood, textile, leather and related materials
- Craft printing and related trades workers

74 Other craft and related trades workers
- Food processing and related trades workers
- Wood treaters, cabinet-makers and related trades workers
- Textile, garment and related trades workers
- Pelt, leather and shoemaking trades workers

Plant and machine operators and assemblers

81 Stationary-plant and related operators

- Mining and mineral-processing-plant operators
- Metal-processing plant operators
- Glass, ceramics and related plant operators
- Wood-processing- and papermaking-plant perators
- Chemical-processing-plant operators
- Power-production and related plant operators
- Industrial robot operators

82 Machine operators and assemblers

- Metal- and mineral-products machine operators
- Chemical-products machine operators
- Rubber- and plastic-products machine perators
- Wood-products machine operators
- Printing-, binding- and paper-products machine operators
- Textile-, fur- and leather-products machine operators
- Food and related products machine operators
- Assemblers
- Other machine operators not elsewhere classified

83 Drivers and mobile plant operators

- Locomotive engine drivers and related workers
- Motor vehicle drivers
- Agricultural and other mobile plant operators
- Ships' deck crews and related workers

Elementary occupations

91 Sales and services elementary occupations

- Street vendors and related workers
- Shoe cleaning and other street services elementary occupations
- Domestic and related helpers, cleaners and launderers
- Building caretakers, window and related cleaners
- Messengers, porters, doorkeepers and related workers
- Garbage collectors and related labourers

92 Agricultural, fishery and related labourers

- Agricultural, fishery and related labourers

93 Labourers in mining, construction, manufacturing and transport

- Mining and construction labourers
- Manufacturing labourers
- Transport labourers and freight handlers

Armed forces

01 Armed forces

- Armed forces